

Virtual Real Time (VRT)

Abstract

Development of flight software for an embedded system requires flight-like test-beds that are usually expensive and hence very few are made. While it is most desirable to perform software testing on the target hardware, its use is often limited to the developers. In addition, debugging in a real-time environment is usually not very productive, as good tools are not available.

Development and test of software in a workstation environment has many benefits. Workstations come with a good number of commercial debugging and analysis tools. The test environment software can be instantiated many times to accommodate multiple users simultaneously. If the software development on workstation and target hardware were to be completely portable, issues such as non-availability of test-beds and lack of good debugging tools will be resolved.

Mission Data System (MDS) architecture developed by JPL allows most of the flight software developing and testing to be done on workstations. MDS uses ACE as the middle layer, which isolates the application and the underlying operating system. However workstation does not provide the same timing as the test-bed with target CPU board.

MDS has developed Virtual Real Time (VRT) capability for the workstation environment. Virtual Real Time along with closed-loop simulation software, provide the capability of running embedded flight software on a workstation in a close-to-real-time environment.

Virtual Real Time is defined as a measure of CPU instructions of a Flight deployment execution in a (UNIX) process on a Workstation. Since VRT is a measure of flight CPU instruction execution, it could be related to the target CPU instruction execution. A VRT scale factor adjusts VRT clock to target CPU hardware clock.

VRT also provides the capability of synchronizing flight software with simulation software and ground software. High-resolution operating system timers provide the necessary time resolution and synchronizing resolution between flight and simulation software. This behavior simulates the real hardware where physical clocks are synchronized by the hardware.

Distributed VRT gives the capability of running Flight software, Ground software and Simulation software on different workstations. Distributed computing improves performance.